WE CLAIM:

1. A method for making a magnetic recording disc for magnetic recording comprising:

providing a disc substrate;

forming a locking pattern in the disc substrate; and

depositing nanoparticles in the locking pattern such that the nanoparticles self-assemble in the locking pattern.

2. The method of claim 1, wherein the nanoparticles comprise chemically synthesized nanoparticles.

3. The method of claim 2, wherein the chemically synthesized nanoparticles comprise FePt, CoPt, FePd or MnAl nanoparticles.

4. The method of claim 1, wherein the nanoparticles have a grain size of 3-10 nm.

5. The method of claim 1, wherein the step of forming the locking pattern in the disc substrate comprises:

applying a layer of photoresist on the disc substrate;

removing select portions of the photoresist to form a topographical pattern corresponding to the locking pattern; and

etching the locking pattern into the disc substrate in areas where the photoresist has been removed.

6. The method of claim 5, wherein the step of forming the locking pattern in the disc substrate further comprises removing the photoresist remaining on the disc substrate after the locking pattern has been etched into the disc substrate.

7. The method of claim 5, wherein the topographical pattern is formed in the photoresist layer using at least one of laser beam lithography, electron beam lithography, deep UV lithography and nano-imprinting.

8. The method of claim 1, wherein the locking pattern formed in the disc substrate includes a pit depth of 5-20 nm.

9. The method of claim 1, wherein the nanoparticles include a self-assembly-coherence length scale of 100-1000 nm.

10. The method of claim 1, wherein the locking pattern is etched into the disc substrate using a reactive ion etching process.

11. The method of claim 1, further comprising:

depositing a first chemical substance on the disc substrate at areas corresponding to the locking pattern, the first chemical substance attracting the nanoparticles; and

depositing a second chemical substance on the disc substrate at areas not corresponding to the locking pattern, the second chemical substance repelling the nanoparticles.

12. The method of claim 1, wherein the disc substrate comprises glass, quartz, Si, SiO_2, ceramic or AlMg.

13. A magnetic recording disc for magnetic recording comprising:

a disc substrate having a locking pattern formed therein; and

nanoparticles completely filling the locking pattern and exhibiting short-range order characteristics.

14. The magnetic recording disc of claim 13, wherein the nanoparticles comprise chemically synthesized nanoparticles having a grain size of 3-10 nm.

15. The magnetic recording disc of claim 14, wherein the chemically synthesized nanoparticles comprise FePt, CoPt, FePd or MnAl nanoparticles.

16. The magnetic recording disc of claim 13, wherein the disc substrate comprises glass, quartz, Si, SiO_2, ceramic or AlMg.

17. The magnetic recording disc of claim 13, wherein the locking pattern formed in the disc substrate includes a pit depth of 5-20 nm.

18. The magnetic recording disc of claim 13, wherein the nanoparticles include a self-assembly-coherence length scale of 100-1000 nm.

19. The magnetic recording disc of claim 13, further comprising a protective coating layer covering the disc substrate and the nanoparticles.

20. A method for making a magnetic recording disc for magnetic recording comprising:

providing a disc substrate having a layer of photoresist thereon;

removing select portions of the photoresist to form a topographical pattern;

etching a locking pattern, corresponding to the topographical pattern, into the disc substrate in areas where the photoresist has been removed;

removing the photoresist remaining on the disc substrate after the locking pattern has been etched into the disc substrate; and

depositing nanoparticles in the locking pattern, such that the nanoparticles self-assemble in the locking pattern.

21. The method of claim 20, wherein the nanoparticles have a grain size of 3-10 nm, and wherein the locking pattern formed in the disc substrate includes a pit depth of 5-20 nm.

22. The method of claim 20, wherein the nanoparticles include a self-assembly-coherence length scale of 100-1000 nm.

23. The method of claim 20, further comprising the step of applying a protective coating layer on top of the disc substrate and the nanoparticles.

24. The method of claim 20, wherein the nanoparticles comprise chemically synthesized FePt, CoPt, FePd or MnAl nanoparticles.

25. The method of claim 20, further comprising the step of providing a chemical substance between the disc substrate and the photoresist, the chemical substance repelling the nanoparticles, wherein the chemical substance is removed from the disc substrate at areas corresponding to the locking pattern via the etching step.

26. A method for making a magnetic recording disc for magnetic recording comprising:

providing a disc substrate having a Sol-Gel-type coating thereon;

nano-imprinting a locking pattern into Sol-Gel-type coating;

drying the Sol-Gel-type coating; and

depositing nanoparticles in the locking pattern, such that the nanoparticles self-assemble in the locking pattern.